

FINAL EVALUATION OF PROJECT HOPE'S BIOMEDICAL ENGINEERING PROJECT IN MACEDONIA

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Submitted to USAID/W ENI/HR/EHA
and
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ENI/HR Technical Assistance Project
(Contract No. DHR-0037-C-00-5067-00;
Task Order 001)

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ERRATA SHEET

FOR

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Purpose: To replace the fifth full paragraph on page 11 of the original report. A reissue of page 11 is attached.

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EXECUTIVE SUMMARY

The Macedonia Biomedical Engineering Project is among the last of a wide range of activities implemented as part of the U.S. Agency for International Development's (USAID) Humanitarian Emergency Medical Supply Project authorized in November 1990. The Omnibus project financed medical supplies, equipment and technical assistance for health care delivery systems in eleven countries.

The objectives of the Humanitarian Emergency Medical Supply Project included:

- C the provision of quick, highly visible responses to medical emergencies faced by weak economies;
- C the reduction of deaths due to influenza, pneumonia and related illnesses;
- C the enhancement of medical systems to facilitate effective response to emergency conditions which might affect high-risk populations; and
- C the support of country and regional communication networks critical to identifying epidemics and delivering required supplies.

In 1992 Macedonia sheltered over 36,000 refugees, 70 percent of whom were housed in private homes and expected to use Macedonia's regular health facilities. Project HOPE surveyed Macedonia and delivered medicines and medical supplies worth \$1 million. USAID/Skopje sought to identify a further practical, emergency-oriented activity. After a brief study, a short-term endeavor to assess, repair, or replace key medical equipment in Macedonia's hospitals was suggested.

Project HOPE had the requisite experience, skills, and interest in implementing such an activity. During March through April 1994, Project HOPE sent a team to evaluate, survey, and inventory biomedical equipment in Macedonian hospitals. In June, Project HOPE proposed a two phase biomedical restoration program for Macedonia, the first phase of which received USAID approval and is the subject of this evaluation.

A two-person team, Geri Marr Burdman and Edward Glaeser, from BHM International, Inc.'s ENI/HR Technical Assistance Project evaluated the project between November 13th and December 12th, 1995. The purpose of the evaluation is: 1) to assess Project HOPE's performance in providing oversight and support to the biomedical project in Macedonia, and 2) to assess and measure the field impact of funded activities.

PRINCIPAL FINDINGS AND CONCLUSIONS

Following is a summary of the evaluation team's findings and conclusions regarding progress to date (on the major activities).

Project Initiation and Planning

- C The project was well designed and in accord with the original objectives of the Humanitarian Emergency Medical Supply Project. Project HOPE, working in coordination with USAID, designed a project highly relevant to Macedonia's immediate needs.

Repair and Maintenance of Equipment

- C Project HOPE field staff were forced by circumstances to set up a system and themselves implement the bulk of repair actions without significant participation from Macedonian counterpart personnel.
- C Despite having to work without key counterparts, Project HOPE engineers and technicians restored to service a significant amount of essential medical equipment. The project came close to meeting its objective of working on most of the highest priority repairable clinical equipment in the Ministry of Health (MOH) hospitals outside of Skopje, the capital city. Records indicate that approximately 90 percent of such equipment had been dealt with as of the time of this evaluation.
- C Project HOPE was able to establish credibility with a wide range of local hospital directors, and enlist the support of two of the best who agreed to use their facilities and staff to operate regional service centers.

Training

- C Training objectives of the project went largely unmet, at least in the first year of operations, due to the paucity of technicians and engineers in the target hospitals and the unavailability of counterparts and a partner institution. Also, Project HOPE staff were otherwise occupied with the actual diagnosis, calibration, and repairs of equipment, which did not allow time to concentrate on training.
- C Project HOPE staff performed primarily informal on-the-job training activities.

Project Administration

- C A well-designed implementation plan was produced but could not be adhered to due to circumstances beyond Project HOPE's control, the dropping out of a key potential counterpart; and a range of challenges, mainly personnel issues, having to do with Project HOPE's administration of the project.
- C In all cases, Project HOPE headquarters staff took responsible corrective action; nonetheless, valuable implementation time was lost and program execution suffered from staff discontinuity.

- C Lack of direct access to counterparts meant that Project HOPE had to rely on the Agood offices@of USAID/Skopje to communicate with Ministry personnel at top levels. This may have been partly the cause of delays in the signing of an agreement between USAID and the MOH for support of the two regional service centers.

Project Impact

- C Data proving that the project had impact on the delivery of patient care was unavailable; however, anecdotal evidence indicated that the project significantly improved the capacity of hospitals to serve patient needs.

Institutionalization/Sustainability

- C The project reached the end of its first full year of implementation without putting in place the key elements needed for institutionalization. However, the basic building blocks for an institutionally sound and perhaps sustainable effort in the form of two regional service centers is close to being achieved as the first phase of the project closes out.
- C In order to assure that efforts to date to build an institutional capacity have a chance to reach fruition, it is important that outside support to the regional service centers continue.

RECOMMENDATIONS

The following are the evaluation teams main recommendations.

1. Consideration should be given to Project HOPEs proposal for a short-term extension. The evaluation team recommends a six month extension to focus on: a) implementation of two service centers (Bitola and Kumanovo); b) diagnosis and repair of the remaining equipment in the repairable category; c) installation of spare parts in the equipment that is currently dismantled; and d) development of a competency-based training plan for users (hospital personnel) and technicians.
2. Project HOPE in future projects similar to the Macedonia Biomedical Equipment Project should screen and orient field personnel more thoroughly.
3. Project HOPE in future endeavors with any donor should insist upon and assure that they are able to establish direct working relationships with key Ministry personnel to the highest level.

ACKNOWLEDGMENTS

Many people assisted in the completion of this study. We thank especially USAID Representative Linda Gregory for her time and support and for allowing two key USAID staff to assist in evaluative deliberations and to interpret for the team; Melita Chokrevska and Rajna Chemerska proved to be fine professionals and delightful and informative traveling companions. We are also grateful to Project HOPE/Skopje staff members Witold Poniklo, Francisco Torres, and Milanja Minovska for setting up appointments and assuring our exposure to the full range of project activities in Macedonia. Finally, we wish to thank all the physicians, staff, and technicians in the hospitals of Macedonia who gave so generously of their time to orient the team and respond to questions.

I. INTRODUCTION

A. Background and Context

The Macedonia Biomedical Engineering Project, the subject of this evaluation, is among the last of a wide range of activities implemented as part of the U.S. Agency for International Development's (USAID) Humanitarian Emergency Medical Supply Project originally authorized in November 1990.

This "omnibus" 1990 project was designed to finance medical supplies, equipment, and technical assistance for health care delivery systems in seven states (then-Czechoslovakia, Estonia, Hungary, Lithuania, Latvia, Poland and former Yugoslavia). In 1992, the list of eligible countries was expanded to include Albania, Bulgaria, Romania, and Macedonia.

The design framework for the Humanitarian Emergency Medical Supply Project may be outlined as follows:

Program Goal. Reduce the number of deaths due to influenza, pneumonia, and other related illnesses by improving the supply of necessary pharmaceutical and medical supplies and equipment.

Program Purpose. Assist health care systems in Central and Eastern Europe in meeting priority requirements for medical supplies and equipment, and technical assistance, thereby enhancing the systems' capability to provide an adequate level of care for the citizens of their respective countries.

Other objectives were:

- C to provide quick, highly visible responses to possible near-term medical emergencies faced by new, weak economies;
- C to reduce the number of deaths due to influenza, pneumonia, and related illnesses;
- C to enhance the ability of medical systems to respond to emergency conditions that might affect high-risk populations; and
- C to support country and regional communication networks critical to coordinating the identification of epidemics and delivery of required supplies.

Target populations for the overall activity were infants and children, the elderly, and the unemployed.

USAID requested proposals from private voluntary organizations (PVOs) interested in implementing all or parts of the Humanitarian Emergency Medical Supply Project. Project HOPE was the only respondent. HOPE was awarded a cooperative agreement to implement the overall project and quickly mounted activities in many countries in the region. In the winters of 1990 and 1991, HOPE supported influenza vaccination programs. By mid-1992, Project HOPE completed medical assessments in all target countries. The identified needs ranged from basic medical and pharmaceutical supplies to technical assistance for the design of immunization programs to prevent the spread of tuberculosis (TB) and hepatitis B. In early 1993, HOPE supported a medical assessment among refugees in Croatia and Bosnia and provided medical and food production supplies; building equipment and other materials; and training for trauma care professionals.

In 1992, Macedonia sheltered over 36,000 refugees. Multilateral organizations, primarily the United Nations High Commissioner for Refugees (UNHCR), were the main source of emergency supply deliveries to Macedonia. Since 70 percent of refugees were housed in private homes and were expected to use Macedonia's regular health facilities, emergency supplies passed directly through the Ministry of Health (MOH) to the facilities. Project HOPE was asked to supplement supplies delivered by other means and accordingly surveyed Macedonia in the summer of 1992. HOPE then purchased and delivered to the MOH medicines and medical supplies worth \$1 million.

In 1993, USAID decided that the emergency medical needs in most of the target countries were being adequately met. The exception was the need for assistance to victims and refugees of the deteriorating situation in the former Yugoslavia and the unmet humanitarian needs of Albania, Romania, and Macedonia. The Humanitarian Emergency Medical Supply Project refocused on these priorities and was extended for an additional two years to December 12, 1995. Project funding increased from \$12.9 million to \$17.9 million. The extension period was to supply additional pharmaceutical supplies, vaccine, equipment, and technical assistance and to meet other emergency needs identified by USAID representatives in the newly designated priority countries.

In Macedonia in May 1993, Project HOPE proposed a new activity focused on decreasing infant mortality and morbidity. Given the relatively high skills and long experience of the Macedonian medical community in dealing with such problems, the lack of organization in the neophyte MOH, and lack of data to show whether such a program would have any lasting effect, USAID did not respond favorably to HOPE's proposal. Instead, the USAID Representative in Skopje sought to identify more practical emergency-oriented activities relevant to immediate local medical needs.

Among the initial ideas was the possible replacement of some of Macedonia's ambulance fleet. As this idea was researched, however, it became clear that Macedonia faced a problem with medical equipment in general. Much of the country's equipment was old and out of repair. While USAID and other donors continually received requests for new equipment from all levels of the MOH system, the solution was costly and offered no assurance that the equipment would be well used or properly maintained. Where equipment requests were met by donors, donations were ad hoc, and equipment often ended up in hospitals in the capital region. The USAID Representative therefore developed the idea for a short-term program to assess, repair, or replace systematically key medical equipment in Macedonia's hospitals.

The USAID Representative decided to explore this strategy and sought an organization to research the idea further. Project HOPE, as it turned out, demonstrated just the requisite experience, skills, and interest in such an activity.

Preparations began for a Macedonian project. During March through April 1994, Project HOPE fielded a six-person team to evaluate, survey, and inventory biomedical equipment in Macedonian hospitals. In June 1994, Project HOPE described the details for a two-phase biomedical restoration program for Macedonia, the first phase of which received USAID approval and is the subject of this evaluation.

B. Country Setting

Landlocked Macedonia, the least developed of the former Yugoslav republics, seceded from Yugoslavia in November 1991. The country has become a member of the United Nations as the "Former Yugoslav Republic of Macedonia" (FYROM).

Macedonia is situated in the southern part of the Balkan Peninsula and covers an area of 25,713 square kilometers with a total population of 2,075,196 (1994 census).

In the late 19th century Macedonia achieved independence from the Turks and, for much of the present century, was the southernmost province of Yugoslavia. Macedonia was the only former Yugoslav republic to gain independence peacefully; however, it is presently experiencing many of the same challenges as the other Eastern European countries in transition from a centralized to a market economy and from a socialized to a democratic society.

Macedonia has some advantages over its neighbors; however, the country has had to deal with the effects of compliance with United Nations-mandated sanctions against Serbia, which accounted for 60 percent of Macedonia's markets before the disintegration of Yugoslavia. Serbia also served as a conduit to other East, Central, and West European markets. Further, Macedonia has had to cope with the effects of the trade embargo imposed by Greece in February 1994. The embargo is the result of a conflict over the name "Macedonia," which Greece claimed could properly be used only to refer to its northern province.

Since its independence from Yugoslavia, Macedonia has had to create a government structure to deal with such issues as fiscal policy, monetary policy, public investment planning, budget, taxation, and revenues.

Macedonia's Ministry of Health has faced considerable pressure in the past five years. According to representatives of the MOH, the health care system has suffered from such events as the influx of refugees in 1991 and inflation and disruption in the provision of medical supplies (only 20 percent of which are produced in-country). Further, the lack of financial support left many people unable to pay for health care as the health insurance system underwent changes.

As the capacity to deliver care diminished, the needs for health care have increased substantially. Physicians interviewed for this evaluation indicated that Macedonia's rate of infant mortality has increased in the last few years as has the incidence of low birth weight babies and clinical malnutrition in children. At the other end of the lifespan, health care providers also report an increasing number of lifestyle and stress-related disorders, including heart disease, cancer, and lung diseases.

The severity of the economic situation has greatly affected the quality and standard of care in the health care system. While there are many fine clinicians in all areas, their ability to provide adequate health care services has been and remains impeded by the lack of properly functioning equipment for diagnosis and treatment of common health and medical problems affecting all ages of the general population.

C. Purpose and Scope of Evaluation

The purpose of the evaluation was twofold: 1) to assess Project HOPE's performance in providing oversight and support to the biomedical project in Macedonia, and 2) to assess and measure

the field impact of funded activities when compared to the goals and objectives specified in the cooperative agreement (see Appendix A, Scope of Work).

A two-person team, Geri Marr Burdman and Edward Glaeser, from BHM International, Inc. conducted the evaluation. During the fieldwork, the evaluation team was accompanied by either Melita Chokresvska or Rajna Chemerska, USAID/Skopje interpreter/translator and assistant to the USAID Representative, respectively. The evaluation took place between November 13th and December 12th, 1995; fieldwork in Macedonia between November 16th and 28th, 1995.

The methodology was straightforward and consisted of archival research and interviews of record with 42 persons (see Appendix B). In addition, hospital visits included brief discussions with numerous other auxiliary personnel whose names were not recorded.

Semi-structured interviews were conducted with hospital directors, doctors, nurses, engineers, and technicians in a sample of eight hospitals. Other interviews included HOPE and USAID staff, individuals working with other donors in the health sector, and two representatives of the MOH in Skopje. A questionnaire format (see Appendix C) guided the interviews.

The eight hospitals included in the sample were selected in consultation with Project HOPE staff. The selection criteria ensured that the team was exposed to a range of facilities that the HOPE staff felt were either 1) the best organized, receptive, responsive, and successful in the project (five facilities); or 2) those least successful or most problematic (three facilities).

For data on persons trained, spare parts, service manuals provided, and numbers and types of equipment repaired, the team relied on information provided by Project HOPE. In the course of conducting interviews in the field, the evaluation team attempted to assess the accuracy of the information reported by Project HOPE as well as the significance and potential impact of Project HOPE activities.

II. FINDINGS

A. Project Initiation, Assessment, and Planning

In preparing to implement the project, Project HOPE responded readily and with obvious skill to a request from USAID and the Minister of Health of Macedonia to evaluate the status of the clinical equipment for a major portion of the hospitals and clinics in the country. Project HOPE fielded a team of six experts to conduct an on-site study to establish the specific types, ages and locations of all major clinical equipment and to evaluate its operational condition and need for repair. The team also assessed the capability of clinical staff to use and technical staff to maintain and repair the equipment. The team established a database inventory of equipment in the major hospitals and clinics.

This first step in considering a possible project also demonstrated excellent coordination among the interested parties. The team noted evidence that USAID/Skopje and MOH personnel were well prepared to assist the Project HOPE survey team. Before the arrival of the Project HOPE survey team, the various parties collected equipment inventory lists from dozens of hospitals and completed many logistical and other arrangements (interpreters) to facilitate the study.

The Clinical Equipment Survey conducted by Project HOPE during March and April 1994

identified 2,216 pieces of clinical equipment at 38 MOH facilities in Macedonia. The surveyed equipment was placed into three groupings as follows:

Group 1, Usable	1,774
Group 2, Repairable (potentially usable after repair and calibration)	304 2,078
Group 3, Throwaway	138
Total pieces of MOH clinical equipment	2,216

The 2,078 pieces of equipment grouped as "usable" or "repairable" required detailed diagnostic evaluation. If the equipment was functioning, the evaluation determined its level of accuracy. If the equipment was not functioning, the evaluation determined what parts and repair operations were necessary to resume service.

The resulting report, entitled "Report on a Survey, Inventory, and Evaluation of Clinical Equipment in the Hospitals and Clinics of Macedonia March, April 1994" provided the basis for the design of HOPE's project for remedial action. The survey was followed up less than a month and a half later with a full proposal dated June 23, 1994, and entitled "A Restoration Program for Clinical Equipment in the Hospitals and Clinics of Macedonia." The two-phase program plan stated that the overall objective was to provide the MOH of Macedonia with a sustainable technology component to improve delivery of health care. HOPE's work was to include the following objectives:

- C the repair-refurbishing of existing clinical equipment to the extent justified by the age and status of the equipment;
- C the establishment of a functional repair-maintenance capability for equipment;
- C a training program for both the medical user and technical maintenance support personnel; and
- C the establishment of a technical-administrative organization within the MOH to direct the general allocation of the country's resources relative to the specification, selection, utilization, and maintenance of clinical equipment and the general supervision of the technical personnel in the MOH.

Our study of formative documents concerning the program along with our findings based on interviews in the field with other donors, indicated that the project had been planned with alacrity and provided a solid base for action. Information collected in the survey provided a sound basis for the design of the June proposal with such objectives as those listed above. Its findings and analysis of medical education and equipment service needs and of the overall public health situation in Macedonia were insightful and informative. The design of the program provided an adequate base to allow Project HOPE to determine and describe the magnitude of a program for diagnosing problems, determining spare parts needed, obtaining parts and repairing equipment, training technicians, and specifying new and replacement equipment needs.

Clearly, the 1994 report established the basic parameters for action as well as a baseline against which to measure success in terms of outputs, if not impact. Regarding impact, Project HOPE warned in its assessment that it would be difficult to find evidence of significant outcome measures by mounting the type of biomedical repair program suggested by the survey. Reliable

data simply were not available then--and are not available now--for use in gauging with certainty the difference the repair of some key equipment has made concerning patient care or specific treatment programs. This foreseen shortfall, however, does not mean that the program should not have gone forward. As designed, the program was in accord with USAID's original 1990 intentions when the overall Humanitarian Emergency Medical Supply Project was authorized.

The evaluation team found the Project HOPE Macedonia Biomedical Equipment program to have been a creative and appropriate response to the circumstances in which Macedonia found itself. The program was established with good focus and coordination in terms of substance and needs. Hospital staff, Ministry personnel, and other donors with whom the team met all attested to the relevance of the program and quality of its design.

B. Field Implementation, Process and Results

The following is a summary of the evaluation team's findings and conclusions regarding progress to date (on the major activities).

1. Repair and Preventive Maintenance

The first priority of the Project HOPE program was the repair-refurbishing of existing clinical equipment to the extent justified by the age and status of the equipment. The team found that despite the relatively short time the project has been functional--about a year at the time of our visit--Project HOPE had made considerable progress in the first of its proposed tasks: the calibration, repair, and return to service of as many potentially usable (2,078) pieces of equipment as possible.

HOPE established its priorities as follows. Of the 2,078 pieces of equipment originally surveyed, 1,810 were located outside Skopje which (as per agreement with USAID) would receive priority treatment. Of these, 311 were identified as high priority. Project HOPE reported in August that 285 of the 311 pieces of equipment had been diagnosed, calibrated, placed back in service, or were awaiting parts. At that time, another 150 service interventions were scheduled for the period September 1, 1995, to December 12, 1995, for a total of 435 interventions covering almost all of the priority equipment and a range of second-priority equipment as well.

A list received by the evaluation team showing progress through November 24, 1995, indicated the status of 512 service interventions and showed duplicate interventions on some equipment (see Appendix D). It was clear from field interviews that Project HOPE technicians sometimes had to deal with repairing the same piece of equipment. Nonetheless, the project has come close to meeting its goal of carrying out technical interventions on the highest-priority (repairable, "R") clinical equipment in the MOH hospitals outside Skopje. Records indicate that approximately 90 percent of such equipment had been dealt with as of the time of this evaluation.

Other tasks laid out in Project HOPE's proposal are listed and commented on below.

- C Task.** Procurement of service manuals for as many of the MOH pieces of equipment as possible.

Some of the service manuals have been procured; however, doing so has been difficult due to the large number and obsolescence of manufacturing sources. Attempts to obtain not only

service manuals but also to repair parts were often unsuccessful because equipment manufacturers no longer carry parts and the technical documentation for equipment is no longer produced. Project HOPE personnel are continuing to pursue the procurement of service manuals from many sources.

- C **Task.** Establish priorities in conjunction with the MOH and 38 hospitals regarding equipment repair needs.

The Project HOPE survey discussed above is regarded as a major project accomplishment in that it identified the current equipment situation countrywide. Project HOPE follow-up to the survey is one of assuring with its own technicians that key equipment is repaired, and not one of installing any system for use by individual hospitals or the MOH in general. The evaluation team found that the present repair system used by the MOH is pragmatic. In a given medical facility, the technical staff (if available) can undertake small repairs that cost less than 3,000 denars. Proposals for major repairs must be submitted to a hospital committee that determines the importance of the equipment in relation to the budget available to finance the repair. Repairs other than those provided by Project HOPE usually are financed by letting a service contract with a manufacturer, a very costly and time consuming process.

- C **Task.** Diagnose and repair equipment and undertake preventive maintenance (PM).

To date, the evaluation team found that Project HOPE engineers or technicians generally carried out repairs. In some instances, repairs were carried out along with Macedonian technicians; however, the use of local technicians was possible only to a limited degree because many hospitals had no technicians available to work jointly with Project HOPE engineers. Likewise, the team found that little preventive maintenance is performed at most hospitals due to the lack of either funds or skilled technicians on site. Generally, resident medical staff used important equipment carefully, although the equipment was not routinely checked for prospective functional problems.

It is important to note, however, that the original project design had identified a means to ensure both in-hospital and extra-hospital processes to repair and maintain equipment. While in-house technicians and medical staff were to have been identified and trained to deal with equipment, a concentrated effort to work with an organization called Replex was also planned. Replex was to have supplanted the centralized medical equipment repair system in use before Yugoslavia broke up. Under the original program proposal, Project HOPE was to work with Replex to ensure that the two organizations would jointly create a service center to handle all hospital equipment repairs for the entire country.

As the program evolved, however, Replex became a nonviable option for establishing service center capability. Replex was privatized and lost a good deal of staff while its leadership showed little interest in providing equipment repair services to Macedonia's MOH system.

The change in the status of Replex had many adverse effects on project implementation. For example, the office space to be provided by Replex was unavailable. Without Replex, Project HOPE found itself without counterpart/country partner relationships at the national level. Overall, Replex's failure to participate delayed by many months installation of a fully functioning repair-preventive maintenance capability in Macedonia and drove HOPE staff back to the drawing board in search of alternative means to provide such capacity.

As a result, Project HOPE, in consultation with USAID/Skopje, decided in February 1995 to set up service centers in collaboration with regional medical centers. Project HOPE staff started looking for two regional hospitals willing and able to take on such a role. Two sites were chosen:

one in Bitola, to serve the southern region; and one in Kumanovo, to serve the northern region. Both had at least one full-time staff engineer or technician, basic repair facilities on which to build, and support of the hospital administration for undertaking the added responsibility and training.

At the time of the evaluation, although both selected regional hospitals were prepared to act as service centers, they had yet to receive final approval from the MOH. Nonetheless, the evaluation team observed that the Kumanova facility had prepared an excellent facility from which the service center could operate, with water sources and extensive electrical wiring already installed. Bitola had identified a site but had done little else to outfit it for use.

2. Training

As originally designed, the biomedical equipment project focused on training at two levels as follows:

- C Users of the equipment needed training to ensure its proper use and efficiency and to be aware of preventive maintenance; and
- C Technical maintenance support personnel needed to be identified and trained to ensure proper maintenance and operation of the equipment.

As indicated in the sections on equipment repair, the paucity of technicians and engineers in the target hospitals and the absence of counterparts and a partner institution meant that the project's original training objectives would remain largely unmet, at least in the first year of operations. Sufficient numbers of personnel could not be identified for training, and/or Project HOPE staff were otherwise occupied with the actual diagnosis, calibration, and repair of equipment and thus could not concentrate on training.

Had the project continued into phase 2 with functioning regional service centers, some concentrated efforts in training would most likely have occurred; however, no systematic plan for competency-based training was in place. At the time of the evaluation, most training carried out by the Project HOPE staff was, with few exceptions, informal on-the-job training as noted below.

Original plan. Design and implement an organized continuing education training program for the medical and nursing staff relative to appropriate utilization and operation of the clinical equipment (particularly related to new equipment acquisition).

Results. The evaluation team found that training for medical and nursing staff has been accomplished only by brief one-on-one communications during the HOPE engineers visits. No organized continuing education of hospital personnel had yet begun. And the MOH had procured little new equipment for participating hospitals during the past year.

Original plan. Establish a program to provide appropriate short courses and workshops in the optimum utilization and operation of the clinical equipment.

Results. The evaluation team found that a limited number of technical education activities had been carried out. Eleven classes ranging from one to four hours in duration were delivered to approximately 15 persons. Many of the same people attended more than one course (see Appendix E for list).

Original plan. Establish continuing education courses appropriate for the levels of nursing practice in secondary and tertiary settings in Macedonia to train nurses specifically in preventive maintenance and safe/appropriate utilization for the provision of nursing care.

Results. Courses were not developed and there was only minimal evidence that nursing staff were included in any aspects of planning and program implementation.

Original plan. Prepare a core group of physicians and nurses trained in utilization, operation, and preventive maintenance of medical equipment to train other groups in key medical and clinical centers in Macedonia.

Results. A limited number of physicians and nurses received one-on-one instruction from HOPE; however, only minimal work was completed in training a core group.

Original plan. Organize appropriate manufacturer's short courses for utilization of new clinical equipment.

Results. Some progress was made in identifying appropriate short courses. E.I. Nish, manufacturer of radiological equipment, and Gambro, Inc., manufacturer of hemodialysis machines and water treatment stations, were enlisted by Project HOPE and agreed to cooperate in training courses. However, no such courses were held during the past year.

Overall, the team found that Project HOPE was acutely aware of the importance of the training aspect of its mission and that service engineers and technicians required not only basic training modules but also much wider education directed to the safe and efficient operation of devices. Unfortunately, within the time allotted for implementation, too little time was available to begin fulfilling such training needs other than on the ad hoc basis described above.

3. Implementation Adaptations

Given the situation Project HOPE confronted in the course of project implementation, the project required a number of adaptations. The evaluation team found the following five most noteworthy:

- C Project HOPE discovered that repair parts and manuals could not be easily procured for the widely diverse (in origin) and often old equipment in Macedonia's hospitals. Thus, responsibility shifted from centralized procurement to an operation centralized in Skopje, where parts from former Bloc countries or Western Europe could be more readily obtained.
- C The issue of staff continuity was in some measure ameliorated by the use of short-term technicians.
- C Electrical surge and voltage problems that might adversely affect the use and longevity of medical equipment were the subject of a special assessment. A generalized overvoltage was discovered, and Project HOPE worked with hospitals and power authorities to make a number of voltage adjustments.
- C Project HOPE noted the meager local production of medical products. Project HOPE staff identified a range of local capacities to produce such medical products as medical creams,

gels, eye drops, I.V. fluids, and plastic tubing. Due to the short-term nature of the project, however, Project HOPE was unable to pursue these possibilities before the time of this evaluation.

- C The withdrawal of Replex as the main center for equipment repair and training required Project HOPE to consider alternative sources for such services. Analysis and study pointed to using two of Macedonia's most progressive hospitals to provide repair services. The evaluation team found that the interviewed hospital personnel approved of this approach.

4. Project Impact

While it was not possible to assess the direct impact of the project on patient care, the evaluation team collected considerable anecdotal evidence indicating that patients did benefit when equipment was returned to service. In nearly all sites visited, interviewees indicated that completed repair work enabled them to better serve patient needs. Such comments took two forms: equipment repaired and returned to use (for example, patient monitors) increased the quality of care; and 2) that calibration of equipment (e.g., X-ray machines and laboratory equipment) facilitated enhanced diagnoses.

Beyond the issue of individual patient care, the project was clearly having impact on the thinking of medical personnel in terms of how to organize and execute meaningful preventive maintenance. The project had definitely spurred hospital officials and staff to attempt to ensure maximum benefit from equipment as Macedonia's health system moves through the transition.

C. Project Administration

The Biomedical Engineering Project did not proceed smoothly at all times. Some of the difficulties slowed implementation considerably.

As stated, the project was initiated with alacrity and skill. After receiving approval from USAID, Project HOPE moved rapidly to recruit staff for the program and to place initial orders for test equipment and some service manuals. Project HOPE also developed a well-devised implementation schedule.

After orientation at HOPE headquarters in Virginia, a team of three technical advisers arrived in Skopje during the first week of November 1994. One team member, however, could not adjust to conditions in Macedonia and resigned on December 2nd, 1994. Nonetheless, the remaining two team members, Witold Poniklo and James Savage, continued to make arrangements for implementation, including the establishment of an office, hospital visits, and ordering spare parts. An able administrative assistant-cum-interpreter was also hired.

At the beginning of 1995, Project HOPE arranged the first of several specialists' visits to Macedonia to augment the skills of the resident team. The first visitor was a specialist in radiological equipment.

In February, Project HOPE headquarters staff--Professor Herman Weed, Director of Biomedical Engineering; and Thomas Roach, Regional Director for Europe--visited Macedonia to evaluate progress. HOPE staff in Skopje reported to both men. Among other things, a decision taken at that time reoriented the purchasing process for spare parts. The determination of source

and availability and the processing of all orders was to become the responsibility of HOPE/Skopje rather than of headquarters staff. The team also agreed to a study of problems in voltage variation, surges, and outages related to electrical power fluctuations at hospitals and shortly thereafter implemented the investigation. It was also becoming apparent at this juncture that Replex would likely not serve as the key counterpart institution for the project.

Detailed reports resulted from the above visit, as well as from those made during implementation. Quarterly reports by HOPE headquarters staff as well as monthly reports from Skopje staff appeared to be well devised and informative.

In his report of the February visit, Professor Weed comments on basic misunderstandings in the job descriptions of the remaining on-site advisers, and that difficulties were beginning to mount between key team members Poniklo and Savage.

In March, the second short-term engineer deployed to work on important X-ray equipment arrived in Skopje. The same month, Jim Savage was evacuated for health reasons. He returned in early April. After his return, turmoil between Poniklo and Savage continued. Savage resigned in late June and was replaced by Francisco Torres, a well-qualified biomedical engineer with much Project HOPE experience. Meanwhile, short-term technicians and engineers continued to arrive as scheduled; in May, a specialist in sterilizers, infant incubators, and lab equipment visited Macedonia. Four additional short-term specialists visited between June and November 1995.

A priority in late summer was to obtain approval from the MOH for funding of two service centers proposed by Project HOPE as replacements for Replex. When approval was not forthcoming, the service center issue became a high priority during Professor Weed's September visit. During that visit, Project HOPE also vetted with USAID/Skopje the idea of phase 2 funding for the project and/or some additional short-term funding beyond the project's December 12, 1995, terminal date.

Professor Weed's September report identifies issues needing attention and posits courses of action. The main pending issue was how to extract approval for the service centers from the MOH. Since the Ministry in Skopje had limited staff, this meant getting the agreement of the Minister himself, and having him instruct subsidiary staff to take action. This had proved to be quite difficult and had dragged on for some months. No agreement on MOH approval of the service centers had been completed at the time of the evaluation team's visit.

Problems with Savage and the conditions of his departure, including communications and representations from him, raised questions about Project HOPE's conduct of financial matters. The evaluation team examined the financial system, albeit briefly, and determined that fund use was well documented and "tested" well regarding receipts and accounting in the period before Savage's departure. Furthermore, the team noted that in September, the financial system was brought to higher standard with the initiation of a more sophisticated coding system for expenses as a result of the visit by Carol Fredriksen, Director of Program Administration, Project HOPE. Fredriksen reviewed all office systems, with particular focus on financial reporting procedures.

Interviews with HOPE's Skopje coordinator indicated that he thought many of the personnel problems described above might have been overcome if HOPE's U.S. staff had been able to explore the problems more fully. To the evaluation team, Poniklo appeared conscientious, hard working, and straightforward, much as he was characterized by other observers from Project HOPE (Professor Weed and Dr. Tim Empkie, HOPE's Regional Director in Prague, who was sent to assess the situation only after Savage departed).

Personnel matters, which became apparent during the evaluation in two ways, definitely

disrupted the project. First, interviews with several hospital directors revealed that Savages abrupt departure disrupted program continuity. As a result, priorities set and promises made by Savage sometimes went unfulfilled. The team did note, however, that Poniklo and Torres attempted to follow up with directors of hospitals serviced by Savage to complete most of the remaining work.

Second, personnel discontinuities made it difficult for the two remaining resident Project HOPE technical advisers to deal fully with their myriad functions, which ranged from a busy and logistically challenging schedule of hospital visits to keeping accounts; scheduling and orienting the work of short-term consultants; ordering parts; writing reports; visiting manufacturers; performing and following up on the electrical energy study; and much more.

D. Institutionalization/Sustainability

The key to the project was the establishment of an administrative capability within the MOH to oversee the logistics of biomedical equipment management for MOH facilities throughout the country. The rationale was that the maintenance of basic technical equipment would require a properly trained and equipped core staff capable of establishing a protocol for the maintenance and proper use of equipment and for training medical staff.

Due to several factors (already mentioned in previous sections of this report), the needed cadre of personnel capable of managing the program has not yet been established. The evaluation team found that the project was far from being institutionalized. The first steps toward institutionalization, support for setting up the two regional service centers, had been planned by Project HOPE by the time of the evaluation but had not been implemented.

Thus, at this juncture, the evaluation team concurs with Project HOPE's own assessment that without additional support, the project cannot aspire to become institutionally sound.

Project sustainability depends on needed capability as well as on proper financing from the MOH, the repair of equipment and supplies, and the identification of personnel to outfit the regional service centers. If the MOH signs the agreement with USAID to provide such financing, the project may well become a relatively self-sustaining and crucial part of the overall MOH hospital system in Macedonia.

E. Issues and Strategy for Potential Follow-up Action

USAID/Skopje recently designed and USAID/Washington approved a strategy and program that no longer foresees investment and support in the health sector. There is little chance, therefore, that Macedonia-specific USAID funds will be available to continue Project HOPE activities over a multiyear period. Other donors may well step in to provide such support in the coming years, but, in the near term, there may be some possibility that USAID can authorize a modest amount of funds for use by Project HOPE to consolidate and follow up on the institutionalization of the Kumanova and Bitola service centers.

The main issue facing the project, which was being closed out as the evaluation team was in-country, is twofold as follows:

- C whether it would be prudent for USAID to fund a short additional tranche of Project

HOPE activity to help ensure that project-supplied equipment repair material that remains in-country is used productively, and that actions taken by the MOH to set up the two service centers are supported with appropriate outside technical and training assistance during their initial period of operation; and

- C the form that such a follow-on activity should take.

If the USAID-MOH agreement has now been signed and HOPE has been authorized by USAID to leave equipment repair material and spare parts with the two service centers, then for reasons implicit in the first issue above, USAID/Skopje should consider further modest support of Project HOPE. Highest priority in the continuing activity should be placed on completion of the two regional service centers and basic training of the technicians, who are the most crucial element in the continuing ability of the Macedonian MOH to maintain existing equipment. A second priority during the continuation would be to install key clinical equipment with the participation of service center staff. Parts have been ordered for this installation, but it was not completed before the December 12th closure of HOPE's Skopje office. One full-time HOPE technical adviser supported by the HOPE center and by short-term technicians from the region likely would be needed.

III. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The evaluation team arrived at the following conclusions:

Project Initiation and Planning

- C Project HOPE working in coordination with USAID designed a project intervention that was relevant to Macedonia's immediate needs.

Field Implementation

Repair and Maintenance of Equipment

- C Project HOPE field staff were forced by circumstances to set up a system and to implement nearly all repair actions without significant participation from Macedonian counterpart personnel.
- C Despite the absence of key counterparts, Project HOPE engineers and technicians were able to service and bring back on line a significant amount of essential medical equipment.
- C Project HOPE was able to establish credibility with a wide range of local hospital directors and to enlist the support of two of the best, who agreed to use their facilities and staff to operate service centers.

Training

- C The project's training objectives went largely unmet, at least in the first year of operation, due to the paucity of technicians and engineers in the target hospitals and the absence of counterparts and a partner institution. In addition, Project HOPE staff were otherwise occupied with the actual diagnosis, calibration, and repair of equipment, which did not allow time to concentrate on training.
- C Training activities carried out by Project HOPE staff were primarily informal on-the-job training sessions.

Project Impact

- C Data proving that the project had an impact on the delivery of patient care was not available; however, anecdotal evidence indicated that the project significantly improved the capacity of hospitals to serve patient needs.

Project Administration

- C A well-designed implementation plan for the project was produced but could not be adhered to because of circumstances beyond Project HOPE's control, such as Replex's decision not to participate, and a range of challenges, mainly personnel issues, related to Project HOPE's administration of the project.
- C In all cases, Project HOPE headquarters staff took responsible corrective action; nonetheless, valuable implementation time was lost and program execution suffered from staff discontinuity.
- C Lack of direct access to counterparts meant that Project HOPE had to rely on the "good offices" of USAID to communicate with Ministry personnel at top levels. Such an arrangement may have contributed to delays in the signing of an agreement between USAID and the MOH for support of the two service centers.

Institutionalization/Sustainability

- C Due to a number of factors, the project reached the end of its first full year of implementation without putting in place the key elements needed for institutionalization. However, the basic building blocks for an institutionally sound and perhaps sustainable effort in the form of two regional service centers are nearly in place as the first phase of the project closes out.
- C To ensure that efforts to date to build an institutional capacity have a chance to reach fruition, it is important to continue outside support to the service centers.

B. Recommendations

- 10 Consideration should be given to Project HOPE's proposal for a short-term extension. Specifically, the evaluation team recommends a six month extension to focus on:

- \$ implementation of two service centers in Bitola and Kumanovo;
 - C diagnosis and repair of remaining equipment in the "R" category;
 - C installation of spare parts in dismantled equipment; and
 - C development of a competency-based training plan for users (hospital personnel) as well as technicians.
2. In future projects similar to the Macedonia Biomedical Equipment Project, Project HOPE should screen and orient field personnel more thoroughly.
 3. In future endeavors with any donor, Project HOPE should insist on and ensure that it is able to establish direct working relationships with key Ministry personnel up to the highest level.

IV. LESSONS LEARNED

- 10 Identifying and working with local counterparts is critical to the success and sustainability of any program whose major focus is the transfer of knowledge and technical skills.
- 20 Training strategies should be developed and implemented in tandem with technical assistance activities.
- 30 The need for communication at the national as well as at the local levels with respect to scope and sequence of project activities should not be underestimated.
- 40 Defining and establishing clear lines of communication within an organization is critical to ensuring an understanding of work responsibilities. Administrative and logistical issues can best be resolved when the persons most affected are involved in problem solving.

APPENDIX A

Scope of Work

APPENDIX B

Persons Contacted

Project HOPE-VA

Herman R. Weed, Director Biomedical Engineering
Leslie Mancuso, Acting Director Medical Operations
Carol Fredriksen, Director of Program Administration
Scott Crawford, Director of Gifts-in-Kind Program

Project HOPE-Macedonia

Witold Poniklo, Chief of Party, Engineer
Francisco Torres, Engineer
Miljana Minovska, Administrative Assistant and Interpreter for Project

USAID/DC

Mary McIntyre

USAID/Macedonia

Linda Gregory, USAID Representative
Melita Chokrevska, Interpreter
Rajna Chemerska, Assistant to AID Representative

Ministry of Health

Dr. Violeta Malinska-Petrusevska, Undersecretary, Ministry of Health, Skopje

Gevgelija

Dr. Boro Kostakev, Head of Surgery
Ms. Violeta Shatareva, Chief Nurse
Engineer Danko Temelkov, Head of Laboratory
Georgi Petkov, General Director

Kumanovo

Dr. Zoran Atanasovski, Director of Hospital
Mr. Srechko Stankovski, Head of Technical Services

Kriva Palanka

Dr. Zharko Jovanor, Director of Hospital

Titov Veles

Dr. Jovan Nikolov, Director
Dr. Jovan Lazousui, Deputy Director
Dr. Cilakov, Head of Operating Room Department

Bitola

Dr. Vlado Popovski, General Director

Ms. Danche Petlichkova, Financial Director
Dr. Mitko Stojanov, Deputy Director
Mr. Zoran Aleksovski, Engineer

Ohrid

Dr. Tosu Klisevski, General Director Cardiology Hospital
Dr. Ilija Prangovski, Cardiologist

Prilep (Medical Center)

Dr. Vlado Georgievski, Director
Dr. Cvetanka Markova, Deputy Director
Dr. Pishtalevska, Outpatient Clinic Director
Mr. Milan Georgievski, Engineer
Dr. Olgica Stojanovska, Director Outpatient Clinic
Marjan Kastoski (X-Ray)
Dr. Antoni Pasoski (Laboratory)

Kavadarci

Dr. Dukadin Manevski, General Director

Gostivar (Medical Center)

Dr. Apostol Apostolovsui, Director
Dr. Ejup Limani, Head of Hospital Services
Mr. Redgepi Rarri, Technician

Other Organizations

UNICEF

Mr. Simon Strachan, Officer in Charge

German Embassy

Ms. Gudrun Masloch, Attachee

ECHO-European Community Humanitarian Organization

Mr. Gerard van Driessche, Coordinator

EC-PHARE

Ms. Maribel Houben, Representative

APPENDIX C

Questionnaire

Key informants: HOPE personnel; AID personnel; MOH Minister, hospital directors, and other staff, including technicians; equipment suppliers

Process: assessment, planning, technical assistance (full-time and consultants); training (informal, formal, etc.), procurement, distribution of supplies/logistics, internal monitoring and evaluation of progress

Categories and initial talking points

I. HOPE's Oversight and Support

How do you rate HOPE's effectiveness in administering this project?

HOPE's U.S. support?

Long-term staff and short-term consultants--How effective a contribution?

Financial management

What are the most positive qualities of the HOPE office in administering this project?
The least?

II. Assessment and Program Planning

What was the program planning process?

How was sequencing of activities determined? By whom?

How much MOH participation was there in setting priorities?

How have priorities been established for servicing the hospitals?

III. Field Implementation

To what degree did the project meet the objectives and quantity of outputs originally forecast?

What were the major constraints to implementation and the effects of these on implementation? Of those overcome, how was this accomplished?

Unexpected outcomes?

IV. Liaison/Interface with MOH

How is this project viewed by the MOH?

With whom have you worked in the MOH?

To what degree and at what levels has the MOH supported the project? What level of MOH support is there for continuing to support this activity?

What have been the involvement and contributions of other donors to the MOH? What are their views concerning the relevance and effectiveness of the HOPE activity?

V. Training

Training actually administered: Type, duration, adequacy?

How this might have been improved?

Training still needed?

VI. Repair and Preventive Maintenance

Do you consider that local capability has been significantly improved? If so, why?

What has been the degree of willingness of MOH staff to participate in maintaining medical equipment?

How many service manuals are available? Where are they kept? Who has access?

To what degree do you see PM as done by Project HOPE as having had field impact? What has resulted from use of repaired equipment that otherwise would not have been possible (e.g., patients dealt with, diagnoses made, progress tracked or monitored, lives spared)?

How would you describe, even if anecdotally, the impact of project on hospital operations, on hospital staff, on treatment of patients?

What, if any, have been byproducts of the main activities that contributed positive results?

VII. Sustainability and Institutionalization

At this juncture, is the program able to stand on its own? If not, why not?

What additional follow-on activities are needed? What do you consider to be the most important follow-on activities in terms of hospital needs? If so, what? What duration?

What does sustainability or institutionalization mean to you? How is training tied into your thinking about sustainability? What are other major factors?

VI. Lessons Learned

APPENDIX D

Equipment Repair Status Report

APPENDIX E

Training Lists and Evaluation Forms

Project HOPE Supervisor Forms for Evaluating Knowledge/Skills